

Occupational Exposure to Cadmium



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Abstract Cadmium, in its elemental state, is either a blue-white, lustrous metal or a grayish-white powder found in lead, copper, and zinc sulfide ores; most cadmium compounds are highly colored from brown to yellow and red. Cadmium is used as an anticorrosive electroplated onto steel, as an electrode component in alkaline batteries, as a component of solders and welding electrodes, and as a stabilizer in plastics. Workers in a wide variety of industries - from manufactures of plastics, ceramics, and paint to industries involving electroplating, metal machining, and welding - are exposed to cadmium.		
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Introduction

Cadmium, in its elemental state, is either a blue-white, lustrous metal or a grayish-white powder found in lead, copper, and zinc sulfide ores; most cadmium compounds are highly colored from brown to yellow and red. Cadmium is used as an anticorrosive electroplated onto steel, as an electrode component in alkaline batteries, as a component of solders and welding electrodes, and as a stabilizer in plastics. Workers in a wide variety of industries—from manufactures of plastics, ceramics, and paint to industries involving electroplating, metal machining, and welding—are exposed to cadmium.

OSHA moved to protect these workers from cadmium exposure as early as 1971, when it adopted the American National Standards Institute's (ANSI) threshold limit values (TLVs) for cadmium as a national consensus standard under section 6 (a) of the Occupational Safety and Health (OSH) Act of 1970. The consensus standard established, for general industry, an 8-hour time-weighted average (TWA) permissible exposure limit (PEL) of 100 micrograms per cubic meter of air ($100 \mu\text{g}/\text{m}^3$) and a ceiling concentration of $300 \mu\text{g}/\text{m}^3$ for cadmium fumes; it also set a TWA PEL of $200 \mu\text{g}/\text{m}^3$ and a ceiling of $600 \mu\text{g}/\text{m}^3$ for cadmium dust. The standard for the construction industry was a TWA PEL of $100 \mu\text{g}/\text{m}^3$ for cadmium oxide fumes and $200 \mu\text{g}/\text{m}^3$ for metal dust and soluble salts.

OSHA decided to reduce these limits in response to a June 18, 1986, petition by the Health Research Group of Public Citizen and the International Chemical Workers Union, as well as evidence of adverse health effects at the then existing PELs. The petitioners, for example, cited several studies that they believed provided evidence of lung cancer and kidney disease from occupational exposure to cadmium at and below the PELs. In July 1987, OSHA determined the necessity for a rulemaking under section 6 (b) of the OSH Act to reduce worker exposure to cadmium.

In February 1990, OSHA published a notice of proposed rulemaking on cadmium.¹ Based on OSHA's review of major epidemiological studies of lung cancer and renal dysfunction among workers and studies of animals exposed to cadmium, and based on the agency's quantitative risk assessment, OSHA proposed PELs of either $5 \mu\text{g}/\text{m}^3$ or $1 \mu\text{g}/\text{m}^3$ to reduce the level of worker exposure to cadmium by more than 95 to 99 percent.

¹*Federal Register* 55 (25): 4052-4147 on February 6, 1990.

OSHA's final rule establishing a new PEL of 5 µg/m³ and other protective provisions for cadmium was published on September 14, 1992, in the *Federal Register* under Title 29 CFR, Part 1910.1027 and is effective as of December 14, 1992.² This booklet is designed to help employers and employees understand and comply with the rule.

Scope and Application

The rule applies to all occupational exposures to cadmium and cadmium compounds, in all forms, and in all industries covered by the OSH Act, including the general, maritime, and agricultural industries. A separate regulation on occupational exposure to cadmium has been issued for the construction industry.³

Provisions of the Rule

Among its provisions, the rule requires employers to (1) adhere to a new PEL and, in a limited number of industrial processes, a separate engineering control air limit (SECAL); (2) monitor the levels of cadmium to which workers are exposed; (3) provide adequate medical surveillance; (4) establish regulated work areas whenever the cadmium levels exceed those mandated by the rule; and (5) maintain records of both exposure monitoring and medical surveillance for specified time periods.

Exposure Limits

Employers must ensure that no employee is exposed to excessive airborne concentrations of cadmium as provided by the standard according to the permissible exposure limit (PEL), the action level, and the separate engineering control air limit (SECAL).

The PEL is a TWA concentration that must not be exceeded during any 8-hour work shift of a 40-hour workweek. The standard requires a PEL of 5 micrograms of cadmium per cubic meter of air (5 µg/m³) for all cadmium compounds, dust, and fumes.

The action level is a level of cadmium in the air of the workplace that is half of the PEL, or 2.5 micrograms per cubic meter of air (2.5 µg/m³), calculated as an 8-hour TWA. If exposure occurs that may be at or above the action level, employers must determine the

²This booklet is not a substitute for requirements of the rule. The complete regulatory text of the cadmium rule and appendices are published in the *Federal Register* 57 (178): 42102-42463, September 14, 1992.

³See 29 CFR 1926.63 for the cadmium standard for the construction industry.

airborne exposure level and follow the provisions in the rule applicable to that level. For example, this includes, among other things, performing air monitoring and providing a respirator to any employee who requests one. In addition, if an employee's exposures are at or above the action level on 30 or more days per year, the employer must provide medical surveillance to that employee. If exposures are determined to be below the action level, the rule only requires that employers train the employees to work in a safe and healthful manner and communicate to them the hazards of exposure to any level of cadmium.

The SECAL is a separate exposure limit to be achieved in specified processes and workplaces where it is not possible to achieve the PEL of $5 \mu\text{g}/\text{m}^3$ through engineering and work practices alone. The SECAL for cadmium is $15 \mu\text{g}/\text{m}^3$ or $50 \mu\text{g}/\text{m}^3$, depending on the processes involved (See page 18). The employer covered by the SECAL is required to achieve that limit by engineering and work practice controls to the extent feasible and to protect employees from exposures above the PEL by any mix of compliance methods, including engineering and work practice controls and respirators.

Exposure Monitoring

Each employer with a workplace or work operation covered by the rule must determine whether any employee, without regard to the use of respirators, may be exposed to cadmium at or above the action level. Employers must do this by measuring the employees' breathing zone air samples to reflect their regular, daily 8-hour TWA exposure to cadmium. Where several employees have identical job classifications, tasks, work areas and work shifts and the length, duration, and level of cadmium exposures are similar, employers may monitor exposure levels by sampling a representative number of these employees instead of all employees. Representative samples, however, shall include employees expected to have the highest cadmium exposures.

Other provisions of exposure monitoring require employers to do the following:

- Monitor employees to determine initial exposures. Monitoring data gathered within 12 months prior to the effective date of the rule may be used if the monitoring conditions closely resemble prevailing ones and satisfy all other monitoring requirements of the rule. Employers also may rely upon objective data in lieu of initial monitoring, where such data demonstrate that employees will not be exposed at or above the action level.

- Sample at intervals no greater than 6 months where the initial or periodic monitoring shows employee exposures are at or above the action level. Employers may discontinue monitoring if employee exposure has been confirmed to be below the action level.
- Conduct additional monitoring whenever there has been a change in raw materials and processes, equipment, personnel, work practices, or finished products that may result in additional exposures to cadmium at or above the action level; that may result in workers previously exposed at or above the action level becoming exposed above the PEL; or whenever employers suspect any other changes might result in such further exposure.
- Notify each affected employee in writing within 15 days after receiving any exposure monitoring results. Also, post the results in an accessible location. The notice must state whether the PEL has been exceeded and describe the corrective action being taken to reduce exposure to or below the PEL.
- Monitor and analyze airborne concentrations of cadmium \geq the action level or PEL with a method that has an accuracy of ± 25 percent and a confidence level of 95 percent.

The employer must offer employees or their designated representatives an opportunity to observe any monitoring. When this involves entering an area where personal protective clothing or equipment is required, the employer must provide such clothing and equipment to the observer and must ensure they are used; observers also must comply with all other applicable safety and health procedures.

Exposure monitoring records must contain the following information:

- The monitoring date, duration, and results in terms of an 8-hour TWA of each sample taken;
- The name, social security number, and job classification of the monitored employee, and of all other employees whose exposure the monitoring represents;
- A description of the sampling and analytical methods used, and evidence of their accuracy;

- The type of respiratory protective device, if any, worn by the monitored employee and by any other employee whose exposure the monitoring represents; and
- A notation of any other conditions that might have affected the monitoring results.

The employer is responsible for maintaining this record for at least 30 years in accordance with the requirements of 29 CFR 1910.20, "Access to Employee Exposure and Medical Records." Such data must show that a particular product or material containing cadmium or a specific process, operation, or activity involving cadmium cannot release dust or fumes in concentrations at or above the action level, even under a worst case scenario. Data can be obtained from an industrywide study or from laboratory product test results by manufacturers of cadmium-containing products or materials.

The data the employer uses from an industrywide survey must be obtained under workplace conditions that closely resemble the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations.

Medical Surveillance

Employers must provide a medical surveillance program for all employees who are exposed or might previously have been exposed at or above the action level, unless the employer can demonstrate that the employee (1) is not exposed to airborne concentrations of cadmium at or above the action level on 30 or more days per year; and (2) did not, prior to December 14, 1992, work for the employer in jobs with exposure to cadmium for an aggregated total of more than 60 months.

Employers must comply with various procedures to satisfy the medical surveillance provisions of the cadmium rule. These include (1) providing medical examinations and biological monitoring tests; (2) taking any necessary corrective actions required by monitoring results; (3) ensuring that medical procedures meet OSHA recommendations, and that employees are allowed to use multiple physician reviews and alternative medical determination procedures, if needed; and (4) giving to and obtaining from physicians the necessary information and data to evaluate an employee's health status. Physicians who require more guidance on the content of these examinations should refer to Appendices A and F in the rule.⁴

⁴See *Federal Register* 57 (178) 42399-42404; 42418-4247, September 14, 1992.

At a minimum, medical surveillance provisions require an initial limited pre-placement examination, a periodic full medical examination within 1 year after the initial examination and biennially thereafter, and annual biological monitoring. The three required biological monitoring tests are cadmium in urine, cadmium in blood, and beta-2-microglobulin in urine. The recommended employer actions triggered by the results of biological monitoring are identified in Appendix A under the rule.⁵

Medical examinations and biological monitoring results may require employers to reassess factors such as work practices, personal hygiene, smoking history and status, respiratory protection, hygiene facilities, personal protective equipment, engineering controls, and correct any deficiencies responsible for excess exposures.

All medical examinations and procedures required by this rule shall be performed under the supervision of a licensed physician (medical doctor) who has read and is familiar with the health information provided in the preamble of the rule, the regulatory text, and Appendices A, D, and F of the rule. Examinations and procedures must be provided without cost to, and at a time and place that is reasonable for, the employee.

Employers must notify employees of their right to seek a second medical opinion after completion of the initial medical examination or consultation. The employer and employee may agree upon the use of any alternate form of physician determination, in lieu of more than one medical opinion (multiple physician review), as long as the alternative is expeditious and equally as protective.

The employer must obtain a written, signed, medical opinion from the examining physician that, to the extent relevant to the employee's exposure to cadmium, includes the following: (1) the physician's diagnosis and any opinion on the status of the employee's medical condition that would place the employee at increased risk from further exposure to cadmium; (2) the results of any employee tests that reveal cadmium exposure; any limitations on the employee's work activities; and (3) a statement by the physician that he or she has clearly and carefully explained the important medical facts to the employee.

⁵Appendix A—Substance Safety Data Sheet, Tables A and B, *Federal Register* 57 (178): 42399-42404, September 14, 1992.

Employers must temporarily remove employees from jobs with exposure to cadmium at or above the AL on each occasion that a physician determines in a written medical opinion that the employee should be removed from cadmium exposure, or where the employee's biological monitoring results are so high as to require mandatory medical removal. The physician may determine the need for medical removal based on biological monitoring results, evidence of illness, inability to wear a respirator, signs or symptoms of cadmium-related dysfunction or disease, or any other reason deemed medically sufficient. When the removal is due to the employee's inability to wear a respirator, the removal need only be from jobs with exposure to cadmium above the PEL.

The employer also must provide employees with the following:

- A copy of the physician's written medical opinion within 2 weeks after receipt;
- A copy of the employee's biological monitoring results within 2 weeks after receipt; and,
- Information that is given to the physician under the provisions of this rule, within 30 days of an employee's request.

The employer also must establish and maintain an accurate medical surveillance record for each employee to whom medical surveillance is provided.

The medical surveillance record must include the following information:

- The name, social security number, and description of the duties of the employee;
- A copy of the physician's written opinion;
- A copy of the employee's medical history, the results of any physical examination and all test results that must be provided by this rule, including biological tests, X-rays, and pulmonary function tests; and any results that have been obtained to further evaluate any condition that might be related to cadmium exposure;
- The employee's medical symptoms that might be related to exposure to cadmium; and

- A copy of the information provided to the physician as required under this rule.

In accordance with the provisions of 29 CFR 1910.20, the employer must retain the medical surveillance records for the duration of the employee's employment plus 30 years.

The employer must make available either to the employee, or to anyone having the written consent of the employee, within 15 days after a request, all required medical records. After an employee's death or incapacitation such records also must be given within 15 days of a request to the employee's family.

Similarly, the employer is responsible for the proper transfer of these records when he or she ceases to do business.

Regulated Areas

An employer must establish a regulated area whenever an employee's exposure to airborne concentrations of cadmium, regardless of respirator use, is or can reasonably be expected to be in excess of the PEL. Regulated areas must:

- Be set apart from the rest of the workplace in a way that establishes and alerts employees to the boundaries of the area;
- Be entered ONLY by authorized persons;
- Be entered ONLY by persons using proper respirators; and,
- Be accessible to employees who refrain from eating, drinking, smoking, chewing tobacco or gum, and applying cosmetics in such areas. Employees must not carry, store, or use products associated with such activities into these areas.

Warning signs bearing the following information must be posted at all approaches to regulated areas:

**DANGER...CADMIUM...CANCER HAZARD...CAN CAUSE
LUNG AND KIDNEY DISEASE...AUTHORIZED PERSONNEL
ONLY...RESPIRATORS REQUIRED IN THIS AREA.**

Similarly, warning labels containing the following information must be placed on shipping and storage containers containing cadmium,

cadmium compounds, or cadmium-contaminated clothing, equipment, waste, scrap, or debris, as specified:

**DANGER...CONTAINS CADMIUM...CANCER
HAZARD...AVOID CREATING DUST...CAN CAUSE LUNG
AND KIDNEY DISEASE.**

To inform employees about cadmium hazards, employers also must comply with the requirements of the Hazard Communication Standard (29 CFR 1910.1200) including such provisions as warning signs and labels, material safety data sheets, and employee information and training.

Methods of Compliance

The employer is required to implement various methods to comply with the PEL and, where applicable, the SECAL. Where the PEL is exceeded, the employer must establish and implement a written compliance program to reduce worker exposure. The written program would include implementing engineering and work practice controls; providing personal protective equipment where necessary; installing proper, hygiene facilities; and adhering to housekeeping practices.

Written Compliance Program

The employer's written compliance program must include at least the following:

- A description of each operation that emits cadmium, including such factors as the type of machinery used, the kind of material being processed, the types of controls in place, the size of the crew, the responsibilities of the employees, the kind of operating procedures, and the type of maintenance practices;
- A description of the specific means used to achieve compliance, including the engineering plans and studies used to select methods to control exposure to cadmium and the use of appropriate respiratory protection, when necessary, to achieve the PEL;
- A report on the technology considered in meeting the PEL;
- Air monitoring data that document the sources of cadmium emissions;

- A detailed schedule for implementing the program, including information on purchase orders for equipment, and construction contracts; and
- A work practice program that includes hygiene facilities and practices and a written plan for dealing with cadmium emergencies.

The written compliance plan also must be reviewed and updated at least annually, or more often if necessary, to reflect any significant changes in the employer's compliance status.

Engineering and Work Practice Controls

Engineering and work practice controls are two primary methods used to protect employees from occupational exposure to cadmium under the rule. Engineering controls reduce employee exposure in the workplace by either removing or isolating the hazard or isolating the worker from exposure. An example of an engineering control is an exhaust system that captures the airborne concentrations of cadmium at the source.

Work practice controls involve the way a task is performed, such as housekeeping and hygiene practices. For example, requiring employees exposed to cadmium to wash their faces and hands prior to eating, drinking, smoking, chewing tobacco or gum, or applying cosmetics is a work practice control.

Employers must implement engineering and work practice controls to reduce and maintain employee exposure at or below the PEL or SECAL, unless the employer can demonstrate that such controls are not feasible. The employer is exempt from implementing engineering and work practice controls to achieve the PEL or, where applicable, the SECAL if the employer demonstrates (1) that the employee is exposed to cadmium above the PEL on fewer than 30 days per year; and (2) that the employee is not otherwise exposed to cadmium.

Whenever engineering and work practice controls are not sufficient to reduce employee exposure to or below the PEL or, where applicable, the SECAL, the employer must still implement such controls to reduce exposures to the lowest levels achievable. Then, the employer must supplement such controls with respiratory protection that complies with the respiratory requirements of the rule and achieve the PEL.

Personal Protective Equipment

Whenever an employee is exposed to cadmium above the PEL, the employer must provide at no cost to the employee, and ensure the employee uses, appropriate protective clothing and equipment that prevent contamination of the employee and the employee's street clothes. Such equipment includes, but is not limited to, respirators, coveralls or similar full-body clothing, gloves, head coverings, boots, face shields, and vented goggles.

The employer is responsible for disposing of and/or properly cleaning, laundering, repairing, and replacing personal protective clothing and equipment. The following requirements pertain to removing, storing, cleaning, replacing, and disposing of personal protective clothing and equipment:

- Provide clean and dry personal protective clothing and equipment at least weekly or more often as necessary to maintain effectiveness.
- Do not allow employees to wear work clothing or take equipment away from the job site. Under no circumstances should cadmium-contaminated work clothes be laundered at home or taken from the work site, except to be laundered professionally or properly disposed of according to applicable federal, state, or local regulations.
- Require that employees remove in designated change rooms, all cadmium-contaminated personal protective clothing and equipment when a work shift is completed.
- Place and store contaminated personal protective clothing and equipment in closed impermeable containers prior to laundering, cleaning, maintaining, or discarding.
- Properly label containers of contaminated protective clothing and equipment when removing them from the change room or workplace to launder, clean, maintain, or discard.
- Prohibit workers from removing cadmium from protective clothing and equipment by blowing, shaking, or any other means that disperses cadmium into the air.
- Launder or clean contaminated equipment in the workplace in a way that avoids releasing airborne cadmium in excess of the PEL.

- Inform any person who launders or cleans protective clothing or equipment contaminated with cadmium of the potentially harmful effects of exposure to cadmium.
- Inform any person who gives contaminated clothing or equipment to another party to launder or clean to warn the party to launder or clean the clothing or equipment in a manner that avoids the release of airborne cadmium in excess of the PEL. The labels must also be in compliance with the Hazard Communication Standard and must state: "Danger...Contains Cadmium...Cancer Hazard...Avoid Creating Dust...Can Cause Lung and Kidney Disease."
- Transport contaminated clothing and equipment in sealed impermeable bags, or other closed, impermeable containers as required by the rule.

Respirators

Where applicable, the employer must provide respirators at no cost to employees and ensure that they are used in compliance with the standard. Respirators shall be used in the following circumstances:

- When exposures exceed the PEL, during the time period necessary to install or implement feasible engineering and work practice controls;
- When exposures exceed the PEL and engineering and work practice controls are either infeasible or not required;
- When all the feasible engineering and work practice controls are insufficient to reduce exposure to or below the PEL;
- When there is an emergency, and whenever an employee who is exposed at or above the action level requests a respirator;
- In a designated regulated area;
- Whenever an employee is exposed above the PEL in an industry where a SECAL is applicable; and

- Whenever an employee is exposed to cadmium above the PEL, and engineering controls are not required under paragraph (f)(1)(iii) of the rule (i. e., excludes the employer from using engineering and work practice controls if he or she can show that the employee's cadmium exposure level is fewer than 30 days per year and the employee is not otherwise exposed to cadmium).

Hygiene Facilities

For employees whose airborne exposure to cadmium—regardless of respirator use or other personal protective equipment—is above the PEL, the employer also must provide clean change rooms, showers, and handwashing and luncheon facilities that comply with the following requirements:

- The employer must ensure that change rooms are equipped with separate storage facilities for street clothes and for protective clothing and are designed to prevent dispersing cadmium and contaminating the employee's street clothes.
- Employees exposed to cadmium above the PEL must shower during the end of the work shift and must wash their hands and faces prior to eating, drinking, smoking, chewing tobacco or gum, or applying cosmetics.
- Luncheon facilities must be readily accessible to employees; tables for eating should be maintained free of cadmium; and no employee in an eating facility should be exposed to cadmium at any time at or above a concentration of $2.5 \mu\text{g}/\text{m}^3$.

Employers must ensure that employees do not enter eating facilities while wearing protective work clothing or equipment unless surface cadmium has been removed from the clothing and equipment by high-efficiency particulate air (HEPA)⁶ vacuuming or some other method that removes dust without causing the cadmium to disperse.

Housekeeping Practices

Under the rule, the employer must adhere to the following requirements:

⁶At least 99.97 percent efficient against mono-dispersed particles of 0.3 micrometers or larger.

- All surfaces must be maintained as free as practicable of accumulations of cadmium.
- All spills and sudden releases of material containing cadmium must be cleaned up as soon as possible.
- Whenever possible, surfaces contaminated with cadmium must be cleaned by vacuuming or other methods that minimize the likelihood of cadmium becoming airborne. HEPA-filtered vacuuming equipment or other equally effective filtration methods must be used for vacuuming. The equipment must be used and emptied in a manner that minimizes the reentry of cadmium into the workplace.
- Shoveling, dry or wet sweeping, and brushing may be used only where vacuuming or other methods that minimize the likelihood of cadmium becoming airborne have been tried and found to be ineffective.
- Compressed air must not be used to remove cadmium from any surface unless the compressed air is used in conjunction with a ventilation system designed to capture the dust cloud created by the compressed air.
- Waste, scrap, debris, bags, containers, equipment, and clothing contaminated with cadmium and consigned for disposal must be collected and disposed of in sealed impermeable bags or other closed impermeable containers. These bags and containers must be labeled according to the provisions of the rule, and disposed of according to applicable federal, state, and local regulations.

Training Program

The employer is responsible for instituting a training program that is accessible to all employees who are potentially exposed to cadmium, ensuring employee participation in the program, and maintaining a record of the contents of such a program. The training must be provided prior to or at the time of the employee's initial assignment to a job that involves potential exposure to cadmium and at least annually thereafter. Additionally, the employer must make the training program understandable to the employee and must ensure that each employee is informed of the following:

- The health hazards associated with cadmium exposure.

- The quantity, location, use, release, and storage of cadmium in the workplace and the specific nature of operations that could result in cadmium exposure, especially exposures above the PEL;
- The engineering controls and work practices associated with the employee's job assignment;
- The ways that employees can protect themselves from exposure to cadmium, including modifying habits such as personal hygiene and smoking; and the specific procedures the employer has implemented to protect employees from exposure to cadmium, such as using appropriate work practices, emergency procedures, and personal protective equipment;
- The purpose, proper selection, fit, use, and limitation of respirators and protective clothing;
- The purpose and description of the medical surveillance program required by the rule;
- The contents of the rule and its appendices; and
- The employee's rights of access to his or her exposure and medical records under 29 CFR 1910.20 (e).

Conclusion

OSHA has determined that cadmium in any form poses a significant threat to the health of workers and can result in kidney damage, lung cancer, or respiratory diseases. OSHA expects that this final will reduce workers' potential risk of serious health effects from cadmium exposure.

Sources of OSHA Assistance

OSHA program services that are available to employers include state plan programs, consultation services, voluntary protection programs, safety and health management programs, and training and education.

State Programs

States administering their own occupational safety and health programs through plans approved under section 18 (b) of the OSH Act of 1970 must adopt standards and enforce requirements that

are at least as effective as federal requirements. There are 23 states and 2 territories with their own OSHA-approved occupational safety and health plans; 23 cover the private and public (state and local government) sectors and 2 cover the public sector only. The states and territories that operate their own OSHA-approved job safety and health programs are listed at the end of this booklet.

Consultation Services

Employers who want help in recognizing and correcting safety and health hazards and in improving their safety and health programs can get it from a free consultation service funded mainly by OSHA. A professional staff administers the service through the state governments. Onsite consultation, among other things, helps employees recognize hazards in the workplace, suggests approaches or options for solving safety or health problems, identifies available sources of help, assists employers in developing or maintaining an effective safety and health program, and offers training and education for employers and employees at the workplace.

The service is given primarily at the work site, but limited services may be provided away from the work site. The service is provided on request mainly to smaller companies in high-hazard industries and will not result in citations or penalties for violations found. The states with OSHA consultation projects are listed at the end of this booklet.

Voluntary Protection Programs

Voluntary protection programs (VPPs) and on-site consultation services, when coupled with an effective enforcement program, expand worker protection to help meet the goals of the OSH Act. The three levels of VPPs—Star, Merit, and Demonstration—are designed to recognize outstanding achievement by companies that have successfully incorporated comprehensive safety and health programs into their total management system. They motivate others to achieve excellent safety and health results in the same outstanding way and they establish a cooperative relationship among employers, employees, and OSHA.

For additional information on VPPs and how to apply, contact the appropriate regional OSHA office listed at the end of this booklet.

Safety and Health Program Management Guidelines

OSHA's recommended *Safety and Health Program Management Guidelines*⁷ issued in 1989 provide a blueprint for employers who seek guidance on how to effectively manage and protect worker safety and health. The four main elements of an effective occupational safety and health program are (1) management commitment and employee involvement, (2) work site analysis, (3) hazard prevention and control, and (4) safety and health training. These elements encompass principles such as establishing and communicating clear goals of a safety and health management program; conducting work site examinations to identify existing hazards and the conditions under which changes might occur; effectively designing the job site or job to prevent hazards; and providing essential training to address the safety and health responsibilities of both management and employees. Instituting these practices, along with providing the correct methods of compliance, can help improve worker safety and health.

Training and Education

The OSHA Training Institute in Des Plaines, IL, provides basic and advanced training and education in safety and health for federal and state compliance officers; state consultants; other federal agency personnel, and private sector employers, employees and their representatives. Institute courses cover areas such as electrical hazards, machine guarding, ventilation and ergonomics. The Institute facility includes classrooms, laboratories, a library, and an audiovisual unit. The laboratories contain various demonstrations and equipment, such as power presses, woodworking and welding shops, a complete industrial ventilation unit and a sound demonstration laboratory. More than 70 courses are available for personnel in the private sector dealing with subjects such as safety and health in the construction industry and methods of voluntary compliance with OSHA standards.

OSHA also provides funds to nonprofit organizations to conduct workplace training and education in subjects where OSHA believes there is a current lack of workplace training. OSHA identifies areas of unmet needs for safety and health education in the workplace annually and invites grant applications to address these needs. Organizations awarded grants use funds to develop training and

⁷*Federal Register* 54 (18): 3094-3916 on January 26, 1989. A single, free copy of the guidelines is available by contacting the OSHA Publications Office at 200 Constitution Avenue, N.W., Room N3101, Washington, DC 20210, (202) 219-4667.

educational programs, reach out to workers and employers for whom their program is appropriate, and provide these programs to workers and employers. Grants are awarded annually, with a 1-year renewal possible. Grant recipients are expected to contribute 20 percent of the total grant cost.

SECALs for Processes in Selected Industries

Industry sector	Processes	SECAL or PEL ($\mu\text{g}/\text{m}^3$)
Nickel cadmium battery	Plate making, plate preparation	50
	All other processes	15
Zinc/cadmium refining	Cadmium refining, casting, melting, oxide production, sinter plant	50
	All other processes	5
Pigment manufacture	Calcining, crushing, milling, blending operations	50
	All other processes	15
Stabilizers	Cadmium oxide charging, crushing, drying, blending operations	50
	All other processes	5
Lead smelting	Sinter plant, blast furnace, baghouse, yard area	50
	All other processes	5
Plating	Mechanical plating	15
	All other processes	5

Source: *Federal Register* 57 (178): 42222, Table VIII-B1, September 14, 1992.

Related OSHA Publications

Single, free copies of the following publications can be obtained from the OSHA Publications Office, U. S. Department of Labor, 200 Constitution Avenue, N. W., Room N3101, Washington, DC 20210, or from the nearest OSHA Regional Office listed in this booklet. Send a self-addressed label with your request.

Access to Medical and Exposure Records—OSHA 3110
All About OSHA—OSHA 2056
Chemical Hazard Communication—OSHA 3084
Consultation Services for the Employer—OSHA 3047
Employee Workplace Rights—OSHA 3021
How to Prepare for Workplace Emergencies—OSHA 3000
Personal Protective Equipment—OSHA 3077
Respiratory Protection—OSHA 3079

The following publications are available from the Superintendents of Documents, U. S. Government Printing Office, Washington, DC 20402, (202) 783-3238. Include GPO Order No. and make checks payable to Superintendent of Documents.

Hazard Communication—A Compliance Kit—OSHA 3104
(A reference guide to step-by-step requirements for compliance with the OSHA standard.)
Order No. 929-022-00000-9; Cost \$18.00 domestic; \$22.50 foreign.

Hazard Communication Guidelines for Compliance—OSHA 3111
Order No. 029-016-00127-1; Cost \$1.00
Job Hazard Analysis—OSHA 3071
Order No. 029-016-00142-5; Cost \$1.00

Principal Emergency Response and Preparedness Requirements in OSHA Standards and Guidance for Safety and Health Programs—OSHA 3122
Order No. 029-016000136-1; Cost \$2.50

Training Requirements in OSHA Standards and Training Guidelines—OSHA 2254
Order No. 029-016-00137-9; Cost \$4.25

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*These states and territories operate their own OSHA-approved job safety and health programs (the Connecticut and New York plans cover public employees only). States with approved programs must have a standard that is identical to, or at least as effective as, the federal standard.